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Stratigraphical interpretation of Chalk Group macrofossils from the Hog's Back structure, Surrey

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Stratigraphical interpretation of Chalk Group macrofossils from the Hog's Back structure, Surrey

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Map

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Foreword

This report describes Chalk macrofossils collected from 69 localities during fieldwork across the Hog's Back structure between Farnham and Guildford, Surrey, in September 2014. This work is in connection with current BGS work to build a physical property model of the Chalk, and will assist in providing surface control for modelled formational boundaries in the subsurface.

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Summary

This work summarises Chalk Group macrofossils, and their stratigraphical interpretation, for 69 localities across the monoclinal fold known as the ‘Hog’s Back’, between Farnham and Guildford, Surrey. This work is in connection with a related project that is developing a Chalk physical property model for southern England. Work across the Hog’s Back infills critical gaps in our knowledge about Chalk stratigraphy and structure in this area.

1 Introduction

This report describes the stratigraphical interpretation of Chalk macrofossils from 69 localities collected by M A Woods (MAW), A R Farrant (ARF) and R K Westhead (RKW) across the Hog's Back structure between Farnham and Guildford, Surrey, in September 2014. The field area is entirely within 1:50 000 geological Sheet 285 (Aldershot). The stratigraphy referred to in this report is given in Table 1, and author citations for fossil species are listed in Appendix 1.

This work is in connection with current BGS work to build a physical property model of the Chalk, and will assist in providing surface control for modelled formational boundaries in the subsurface.

2 Locality description and interpretation

Detailed below are the localities from which Chalk macrofossils were collected in the course of this work, together with their stratigraphical interpretation.

(1) Chalk Pit on north flank of Hog's Back, 150 m SW of Inwood Manor, just N of A31, near Guildford, Surrey.
1:10 000 SU94NW NGR: SU 91116 48423
Specimen nos: WMD 16837 – 16851

The fauna includes:

Bivalvia:	*Cladoceramus undulatoplicatus* (fragments)
	?Neithea sexcostata (fragment)
	oyster (*?Acutostea incurva*)
	Platyceramus (shell fragments, including thick – i.e. c. 5mm)
Echinoidea:	cidarid (test fragment)

Conclusion: White Chalk Subgroup, Seaford Chalk Formation; basal Santonian, mid *M. coranguinum* Zone.

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(2) North-west corner of Greyfriars chalk pit, 275 m NW of Greyfriars Farm, east of Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 94314 48321
Specimen nos: WMD 16852 – 16868

The fauna, collected from a flint-rich interval of nodular chalk, includes the following:

Brachiopoda:	terebratulid
Bivalvia:	*Inoceramus cuvieri?* (fragmentary and crushed- several specimens)
	Merklinia cf. *variabilis*
Echinoidea:	*Plesiocorys* (*Sternotaxis*) *plana* (several specimens)
	?P. (*S*.) *plana* (crushed)

Conclusion: White Chalk Subgroup, lower Lewes Nodular Chalk (? 'Basal Complex'; Mortimore et al., 2001, p. 279); Turonian, uppermost *T. lata* Zone or basal *P*. (*S*.) *plana* Zone.

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(3) Westernmost of two old chalk pits, east of West Farm, c. 520 m east of West Farm, near Runfold, Farnham, Surrey.
1:10 000 SU84NE NGR: SU 87844 48136

Specimen nos: WMD 16869-16884
The sparse fauna includes the following:

Brachiopoda:	*?Hyotissa semiplana*
	Kingena lima
	K. lima? (several)
	Orbirhynchia sp.
	Terebratulina striatula
Asteroidea:	skeletal plates
Crinoidea:	*Bourgueticrinus* sp. (columnal)
Echinoidea:	*Micraster* sp. (test fragment)

The fauna is dominated by small fossils in smooth, hard – firm, rather low density chalk. *Platyceramus* is notably absent.

Conclusion: White Chalk Subgroup, ?lower Newhaven Chalk; ?Santonian

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(4) Easternmost of two chalk pits, east of West Farm, 750 m ENE of West Farm, near Runfold, Farnham, Surrey.
1:10 000 SU84NE NGR: SU 88069 48212
Specimen nos: WMD 16885 – 16905

The fauna includes the following:

Porifera:	sponge remains
Bryozoa:	bryozoans
Brachiopoda:	*Terebratulina?*
Bivalvia:	*Acutostrea incurva*
	Mimachlamys cretosa (fragment)
	oyster
	?Platyceramus
	?Pseudoperna boucheroni
Asteroidea:	skeletal plates
Echinoidea:	*Echinocorys* (test fragment)

The fauna occurs in low density, smooth-textured chalk, locally iron-stained and sponge-rich. No definitive *Platyceramus*.

Conclusion: White Chalk Subgroup, ?lower Newhaven Chalk; ?Santonian.

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(5) Field brash in field c. 15 m N of old chalk pit, c. 250 m NNW of Conduit Farm, south of Onslow Village, Guildford, Surrey.
1:10 000 SU94NE NGR: SU 97098 48378
Specimen nos: WMD 16906 – 16910

The fauna is dominated by *Mytiloides* shell fragments in hard chalk, including *Mytiloides mytiloides*.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(6) Chalk pit c. 800 m N of Shoelands Farm, near Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 91274 48152
Specimen nos: WMD 16911 – 16942

The fauna includes the following:

Bivalvia:	*Inoceramus atlanticus* (common)
	Inoceramus aff. *pictus*
	oysters
	Spondylus?
Ammonoidea:	*Acanthoceras?*

Conclusion: Grey Chalk Subgroup, lower Zig Zag Chalk Formation; Middle Cenomanian, *A. rhotomagense* Zone, *T. acutus* Subzone.

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(7) Chalk pit 150 m S of car park on south side of A31 on Hog's Back, and c. 650 m WNW of the Priory, Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 92737 48087
Specimen nos: WMD 16943 – 16971

The fauna includes the following:

Brachiopoda:	*Orbirhynchia mantelliana* (several)
	terebratulids
Bivalvia:	*?Entolium orbiculare*
	Inoceramus ex gr. *virgatus* (several)
	Lima sp.
	?Plagiostoma globosum
	Pycnodonte vesiculare (large)
	?P. (small)
Ammonoidea:	*Schloenbachia* (fragment)
	whorl fragment (*?Mantelliceras dixoni*)

The specimens of *Entolium* and *Plagiostoma* are in hard, silty, glauconitic chalk, at the base of the succession. The remainder of the fauna is from interbedded marls and limestones.

Interpretation: The hard, silty, glauconitic unit, with *?Entolium* and *?Plagiostoma*, is inferred to represent the Upper Greensand. The overlying marl/limestone succession is inferred to represent the West Melbury Marly Chalk, although the basal units appear to be in the *M. dixoni* Zone, suggesting that the *M. mantelli* Zone is faulted-out/thin/condensed.

Conclusion: ?Upper Greensand and Grey Chalk Subgroup, West Melbury Marly Chalk Formation; ?Late Albian and Lower Cenomanian, *M. dixoni* Zone.

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(8) Freshly excavated chalk pit on N flank of Hog's Back, 520 m WSW of White Lane Farm, on west side of White Lane, immediately N of A31, just N of Seale, Surrey.
1:10 000 SU84NE NGR: SU 89981 48379
Specimen nos: WMD 16972 – 16996

The fauna includes the following:

Bivalvia:	*Mimachlamys cretosa*
	Platyceramus (including thick-shelled; common)

Echinoidea: *Conulus* sp. (crushed)
Echinocorys sp.
Micraster sp.

Conclusion: White Chalk Subgroup, upper Seaford Chalk Formation; Santonian, upper *M. coranguinum* Zone.

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(9) Westernmost of two old chalk pits between Seale and Hog's Back, 480 m WNW of church at Seale, Surrey.
1:10 000 SU84NE NGR: SU 89265 48103
Specimen nos: WMD 16997 – 16999

The fauna, in hard, shelly, iron-stained chalk, includes the bivalve *Mytiloides* sp.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk; Turonian, *Mytiloides* spp. Zone.

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(10) Easternmost of two chalk pits between Seale and Hog's Back, 410 m WNW of church at Seale, Surrey.
1:10 000 SU84NE NGR: SU 89347 48119
Specimen nos: WMD 17000 – 17001

The fauna, from a c. 3 m section of flintless, hard, nodular chalk, includes the bivalve *Mytiloides mytiloides?* Some chalk is hard and splintery, and appears to have been secondarily cemented.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk; Turonian, *Mytiloides* spp. Zone.

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(11) Old chalk pit immediately west of Hog's Back Hotel, on north flank of Hog's Back immediately north of A31, 660 m WNW of church at Seale, Surrey.
1:10 000 SU84NE NGR: SU89155 48274
Specimen nos: WMD 17002 – 17011

The fauna is as follows:

Horizon: about half way along western flank
Bivalvia: *Volviceramus involutus* (LV fragment)

Horizon: northern end of western flank
Bivalvia: *Platyceramus* sp (including thick-shelled)
Sphenoceramus sp.
Echinoidea: *Conulus* sp.
Micraster?

The northern end of the quarry, exposing the higher part of the succession, is relatively fossiliferous chalk, with large, elongate nodular flints. The lower part of the succession, at the southern end of the quarry, is less fossiliferous with flints that are more tabular in character, with some sponge-bearing chalk.

The interval between the succession containing *Volviceramus* and that containing the remainder of the fauna is quite thin given the thickness that typically separates these

faunas in the Seaford Chalk. The presence of a fault might explain this unusually close juxtaposition.

Conclusion: White Chalk Subgroup, spanning lower and middle part of Seaford Chalk Formation; upper Coniacian and basal Santonian, lower and middle *M. coranguinum* Zone.

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(12) Old chalk pit in field immediately east of Hog's Back Hotel, on north flank of Hog's Back, immediately N of A31, c. 510 m NW of church at Seale, Surrey.
1:10 000 SU84NE NGR: SU 89401 48314
Specimen nos: WMD 17012 – 17034

The fauna includes the following:

Brachiopoda:	*Isocrania paucicostata*
	terebratulid (large; *?Gibbithyris ellipsoidalis*)
Bivalvia:	*Acutostrea incurva*
	?Cladoceramus
	Mimachlamys cretosa
	oysters
	?Platyceramus (small shell fragments)
Crinoidea:	*Bourgueticrinus* sp. (columnal)
Echinoidea:	cidarid spine (frag)
	Micraster sp. (test frags.)

The fauna occurs in flinty, smooth-textured, but quite hard chalk.

Conclusion: White Chalk Subgroup, mid Seaford Chalk Formation; ?basal Santonian, mid to upper *M. coranguinum* Zone.

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(13) Spoil associated with material infilling trench immediately S of A31 on Hog's Back.
1:10 000 SU94NW NGR: SU 92999 48301
Specimen nos: WMD 17035 – 17036

The fauna includes the bivalve *Mytiloides incertus*, in intensely hard, nodular chalk with local iron-staining.

Conclusion: White Chalk Subgroup, lower Lewes Nodular Chalk Formation; upper Turonian, *P*. (*S*.) *plana* Zone.

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(14) Exposure in drainage ditch immediately S of A31 on Hog's Back, 830 m NE of Shoelands Farm, near Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 92007 48305
Specimen nos: WMD 17037 – 17038

The fauna includes the echinoid *Micraster* sp., possibly *Micraster* aff. *normanniae*.

Conclusion: White Chalk Subgroup, lower to middle Lewes Nodular Chalk Formation; Turonian or basal Coniacian, upper *P*. (*S*.) *plana* Zone or basal *M. coranguinum* Zone.

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(15) Old chalk pit 370 m ENE of Conduit Farm, south of Onslow Village, Guildford, Surrey.

1:10 000 SU94NE NGR: SU 97580 48341
Specimen nos: WMD 17039 – 17040

The material comprises specimens of the heteromorphy ammonite *Sciponoceras*, in very hard Chalk.

Interpretation: The fauna appears to occur in a faulted sliver of Melbourn Rock (basal Holywell Nodular Chalk Formation) in the middle of the chalk pit, bounded above and below by older Zig Zag Chalk Formation. The Melbourn Rock appears in apparently normal succession in the top north-west corner of the pit.

Conclusion: White Chalk Subgroup, basal Holywell Nodular Chalk Formation, Melbourn Rock; Turonian, *Mytiloides* spp. Zone.

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(16) Old chalk pit on W side of B3000, c. 340 m N of the Priory, Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 93400 48148
Specimen nos: WMD 17041 – 17051

The fauna includes:

Brachiopoda:	*Orbirhynchia mantelliana*
	terebratulid (small – *Kingena?*)
Bivalvia:	*Inoceramus* sp.
	inoceramid shell fragments
Ammonoidea:	*Acanthoceras rhotomagense*
	Turrilites costatus

Conclusion: Grey Chalk Subgroup, lower Zig Zag Chalk Formation; Middle Cenomanian, *A. rhotomagense* Zone.

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(17) Old chalk pit on east side of B3000, c. 400 m NNE of the Priory, Puttenham, Surrey.
1:10 000 SU94NW NGR: SU 93546 48173
Specimen nos: WMD 17052 – 17053

The fauna includes the inoceramid bivalve *Inoceramus pictus*, in firm, smooth-textured, creamy-white, flintless chalk, with locally common fracture zones.

Conclusion: Grey Chalk Subgroup, upper Zig Zag Chalk Formation; Middle or Upper Cenomanian.

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(18) Large old chalk pit on north flank of Hog's Back, immediately north of A31, 300 m SW of White Lane Farm, 760 m NE of church at Seale, Surrey.
1:10 000 SU94NW NGR: SU 90265 48395
Specimen nos: WMD 17054 – 17071

The fauna includes the following:

Bivalvia:	*Cladoceramus undulatoplicatus*
	?C. undulatoplicatus
	oysters
	Platyceramus (including thick shell fragments)
Echinoidea:	*Micraster* sp. (mammillated periplastron)

Conclusion: White Chalk Subgroup, middle Seaford Chalk Formation; basal Santonian, upper *M. coranguinum* Zone.

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(19) South side of old chalk pit at Seale (Seale Limeworks), 380 m NE of church at Seale, Surrey.
1:10 000 SU84NE NGR: SU 89958 48184
Specimen nos: WMD 17072 – 17094

The fauna includes the following:

Brachiopoda:	*Terebratulina* sp.
	terebratulids
Bivalvia:	*Inoceramus* sp.
	Mytiloides? (several ex-situ specimens)
	oysters
	Plagiostoma globosum
Ammonoidea:	whorl fragment

Conclusion: Not possible. Presumably Zig Zag Chalk based on field relations. Loose specimens of *Mytiloides?* might be material moved from elsewhere in quarry. ARF and RKW report no evidence of faulting.

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(20) Brash from fallen tree in copse on crest of ridge in Farnham Park, 812 m ENE of Farnham Castle, 700 m SSW of Hale Church.
1:10 000 SU84NW NGR: SU 84650 47700
Specimen nos: ARF 2727 – 2736

The fauna includes the bivalve *Mytiloides* in hard, shelly chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(21) Brash in badger scrape in old pit in copse, Farnham Park, 535 m ENE of Farnham Castle, 1.1 km SW of Hale Church.
1:10 000 SU84NW NGR: SU 84230 47460
Specimen nos: ARF 2737 – 2740

The fauna includes the brachiopod *Orbirhynchia* and the inoceramid bivalve *Mytiloides mytiloides?* in hard, very yellow-stained chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(22) Brash in fallen tree in old pit on N side of Hogs back, 350 m SSW of A331-A31 roundabout, 1.86 km WNW of Seale Church.
1:10 000 SU84NE NGR: SU 87860 48120
Specimen nos: ARF 2741 – 2743

The fauna is as follows:

Brachiopoda:	small brachiopod cf. *Kingena*
Bivalvia:	oyster? (fragment)

Crinoidea: *Bourgueticrinus* (associated columnals)

Conclusion: White Chalk Subgroup, ? at or above mid Seaford Chalk Formation; ? Santonian or younger.

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(23) Brash in bank at northern end of Thundery Lane, Sandy Cross, 785 m SE of A331-A31 roundabout, 1.14 km W of Seale Church.
1:10 000 SU84NE NGR: SU 88530 47950
Specimen nos: ARF 2744 – 2747

The fauna includes the bivalve *Mytiloides* in hard, shelly chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(24) Brash in face of old, mostly infilled pit, 70 m NE of railway footbridge, 1.25 km SE of Hale Church, 200 m SSE of B3208 railway bridge.
1:10 000 SU84NE NGR: SU 8609 4790
Specimen nos: ARF 2748 – 2749

The specimens include an inoceramid of uncertain affinity. It looks like a coarsely ribbed *Mytiloides*, but might in fact represent *Inoceramus lusatiae*.

Interpretation: *I. lusatiae* suggests a level in the late Turonian or basal Coniacian, in the upper *P.* (*S.*) *plana* zone or basal *M. cortestudinarium* Zone, suggesting the middle part of the Lewes Nodular Chalk.

Conclusion: White Chalk Subgroup, ?middle Lewes Nodular Chalk Formation; ?upper Turonian or ?basal Coniacian.

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(25) Brash in drainage ditch on S edge of field, 55 m north of filling station on the A31, 1.12 km ESE of A331-A31 roundabout, 750 m NW of Searle Church.
1:10 000 SU84NE NGR: SU 8901 4824
Specimen nos: ARF 2750

The specimen is a thick-tested *Echinocorys*.

Conclusion: None possible.

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(26) Brash on northern rim of old chalk pit, 175 m NW of Hogs Back Hotel, 1.24 km ESE of A331-A31 roundabout, 670 m NW of Seale Church.
1:10 000 SU84NE NGR: SU 8915 4829
Specimen nos: ARF 2751 – 2752

This locality is the same as (11) (above). The fauna includes barrel-shaped columnals of the crinoid *Bourgueticrinus* sp.

Interpretation: *Bourgueticrinus* is consistent with the Santonian interpretation for the higher part of the succession described in this pit at (**11**) above.

Conclusion: See (**11**) above.

(27) Brash in road bank, c. 60 m down from entrance to Seale limeworks pit, Wood Lane, Searle, 250 NE of Searle Church.
1:10 000 SU84NE NGR: SU 8983 4810
Specimen nos: ARF 2753 – 2754

The specimens are the bivalves *Entolium orbiculare* and *?Plagiostoma*, in low density matrix sediment, possibly representing the Upper Greensand.

Conclusion: ?Upper Greensand; ? Late Albian.

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(28) Brash in rabbit burrow, at edge of infilled pit just north of A31, 450 m ESE of A331-A31 roundabout, 1.40 km NW of Seale Church.
1:10 000 SU84NE NGR: SU 8836 4835
Specimen nos: ARF 2755 – 2756

The specimens comprise an asteroid skeletal plate, and a small, smooth calyx plate of the crinoid *Marsupites testudinarius.*

Conclusion: White Chalk Subgroup, lower Newhaven Chalk Formation; Santonian, *M. testudinarius* Zone.

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(29) Brash in hedge/woods on N side of Hogs back, 170 m north of Hogs Back Hotel, 1.35 km ESE of A331-A31 roundabout, 600 m NNW of Seale Church.
1:10 000 SU84NE NGR: SU 8926 4833
Specimen nos: ARF 2757

The sample comprises inoceramid shell fragments, including *Platyceramus?* and *?Volviceramus involutus* (RV frag).

Conclusion: White Chalk Subgroup, ? lower Seaford Chalk Formation.

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(30) Brash from scree slope beneath eastern face of White Lane Farm Chalk pit, 840 m NE of Searle Church, 670 m W of Hogs Back Trig point.
1:10 000 SU94NW NGR: SU 9037 4836
Specimen nos: ARF 2758

The sample comprises inoceramid shell fragments, including *Platyceramus* and *?Volviceramus involutus* (LV frag).

Conclusion: White Chalk Subgroup, ? lower Seaford Chalk Formation.

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(31) Brash from scree slope at top of western face of White Lane Farm Chalk pit, 656 m NE of Searle Church, 905 m W of Hogs Back Trig point.
1:10 000 SU94NW NGR: SU 9014 4836
Specimen nos: ARF 2759

The specimen comprises inoceramid shell fragments (large and moderately thick-shelled) including *Platyceramus*, and the echinoid *Micraster* sp. (frag).

Conclusion: White Chalk Subgroup, ?Seaford Chalk

(32) Brash in field 35 m north of A31, close to top of ridge, 900 m east of Hog's Back Trig Point, 1.46 km NW of Puttenham Church.
1:10 000 SU94NW NGR: SU 9194 4838
Specimen nos: ARF 2760

The sample comprises inoceramid shell fragments, including *Platyceramus* and *?Volviceramus involutus* (LV & RV frags).

Conclusion: White Chalk Subgroup, ?Seaford Chalk.

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(33) Brash in woods 185 m east of dodgy layby on A31, 510 m NW of Puttenham Church, 500 m WSW of B3000/A31 road bridge.
1:10 000 SU94NW NGR: SU 9297 4823
Specimen nos: ARF 2761

The specimen is the brachiopod *Terebratulina lata*.

Conclusion: White Chalk Subgroup, New Pit Chalk or lower Lewes Nodular Chalk; Turonian, *T. lata* Zone or lower *P.* (*S.*) *plana* Zone.

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(34) Brash in drainage ditch on south side of A31, 860 m W of dodgy lay by, 1.43 km WNW of Puttenham Church, 900 m east of Hog's back Trig point.
1:10 000 SU94NW NGR: SU 9195 4831
Specimen nos: ARF 2762

The specimen is the echinoid *Micraster cortestudinarium?*, in hard chalk with an attached chalk nodule.

Conclusion: White Chalk Subgroup, ? mid to upper Lewes Nodular Chalk.

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(35) Old degraded pit on north side of Hogs Back, 820 m west of Wanborough Church, 900 m NW of A31/B3000 road bridge.
1:10 000 SU94NW NGR: SU 9268 4880
Specimen nos: ARF 2763 – 2764

The fauna comprises an oyster and the crinoid *Bourgueticrinus*.

Conclusion: White Chalk Subgroup, probably at or above mid Seaford Chalk Formation.

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(36) Brash in field, approx 30 m from S and W edge of field, 1.35 km WNW of Puttenham Church, 950 m ESE of Hogs Back Trig Point.
1:10 000 SU94NW NGR: SU 9199 4808
Specimen nos: ARF 2765 – 2768

The specimens comprise indeterminate inoceramid shell fragments in creamy-grey, marly chalk.

Conclusion: None possible.

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(37) North face of old chalk pit (Rack's Close, now a park), Guildford, 180 m SE of Guildford Castle, 142 m east of Quarry Street, 835 m SE of Guildford Station.
1:10 000 SU94NE NGR: SU 9987 4917

Specimen nos: ARF 2769

The specimen comprises inoceramid shell fragments, including *Platyceramus?* and *?Volviceramus involutus* (LV frag).

Conclusion: White Chalk Subgroup, ?lower Seaford Chalk Formation.

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(38) Northeast face of old chalk pit (Rack's Close, now a park), Guildford, 206 m SE of Guildford Castle, 186 m east of Quarry Street, 860 m SE of Guildford Station.
1:10 000 SU94NE NGR: SU 9991 4917
Specimen nos: ARF 2770

The specimen comprises inoceramid shell fragments, including thick-shelled (+5mm) *Platyceramus*.

Interpretation: This locality has since been visited by MAW (material yet to be reported on), and outcrop and faunal evidence suggests assignment to the lower Seaford Chalk Formation.

Conclusion: White Chalk Subgroup, Lower Seaford Chalk Formation.

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(39) North-west face of old chalk pit (Rack's Close, now a park), Guildford immediately east of steps up to Castle gardens, 150 m south of Guildford Castle, 60 m east of Quarry Street.
1:10 000 SU94NE NGR: SU 9979 4916
Specimen nos: ARF 2771 – 2781

The fauna is as follows:

Bivalvia:	*Cremnoceramus crassus* (large fragments in hard, iron-stained chalk)
	C. crassus?
	?C. crassus
	C. deformis deformis
Echinoidea:	*Micraster cortestudinarium*
	M. cortsetudinarium?
	Micraster sp.

Conclusion: White Chalk Subgroup, upper Lewes Nodular Chalk; Coniacian, *M. cortestudinarium* Zone.

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(40) Field brash on crest of ridge, 450 m due south of A331-A31 roundabout, 1.75 km WNW of Seale Church.
1:10 000 SU84NE NGR: SU 8793 4808
Specimen nos: ARF 2782

The fauna specimen comprises inoceramid shell fragments, including *?Platyceramus* and *?Volviceramus involutus* (LV frag).

Conclusion: White Chalk Subgroup, ?lower Seaford Chalk Formation.

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(41) Brash in fallen tree by path, near valley bottom, Walnut Tree Bottom, 1 km SSW of Merrow Church, 1.32 km WSW of Merrow Down trig point.
1:10 000 TQ04NW NGR: TQ 0271 4970

Specimen nos: ARF 2783

The specimen comprises inoceramid shell fragments, including thick-shelled *Platyceramus?*.

Conclusion: White Chalk Subgroup, ?Seaford Chalk Formation or younger.

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(42) Brash on north side of Walnut Tree Bottom, 1.07 km SE of Merrow Church, 950 m WSW of Merrow Downs Trig Point.
1:10 000 TQ04NW NGR: TQ 0311 4966
Specimen nos: ARF 2784

The specimen comprises shell fragments of the inoceramid bivalves *Platyceramus* and *?Volviceramus involutus*, and a fragment of the echinoid *Micraster* sp.

Conclusion: White Chalk Subgroup, ?lower Seaford Chalk Formation; ?Coniacian, ?lower *M. coranguinum* Zone.

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(43) Brash at top of scarp at edge of woods (Emma's seat), 1.70 km SE of Merrow Church, 840 m SW of Merrow Downs Trig Point.
1:10 000 TQ04NW NGR: TQ 0361 4915
Specimen nos: ARF 2785

The specimen comprises inoceramid shell fragments, including thick-shelled *Platyceramus*.

Conclusion: White Chalk Subgroup, Seaford Chalk Formation or younger.

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(44) Brash on path 290 m southwest of Warren Farm, Pewley Down, 1.37 km ESE of Guildford Castle.
1:10 000 TQ04NW NGR: TQ 0112 4920
Specimen nos: ARF 2786

The specimens comprise inoceramid shell fragments, including *Platyceramus* and *?Volviceramus involutus*.

Conclusion: White Chalk Subgroup. ? lower Seaford Chalk.

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(45) Brash at top of southern face of old chalk pit in fallen tree, 2.00 km WNW of St Martha's Hill Church, 1.18 km NE of Shalford Church.
1:10 000 TQ04NW NGR: TQ 0081 4856
Specimen nos: ARF 2787 – 2790

The specimens comprise the brachiopod *Orbirhynchia mantelliana* and an oyster.

Interpretation: This locality has subsequently been visited by MAW (fauna yet to be reported), and this confirms the presence of the boundary of the West Melbury Marly Chalk and Zig Zag Chalk formations near the top of the south face of this chalk pit. The *Orbirhynchia* appear to represent part of the Upper Orbirhynchia mantelliana Band (e.g. Mortimore et al, 2001, fig. 3,119), collected from a level close to the base of the Zig Zag Chalk Formation.

Conclusion: Grey Chalk Subgroup, upper West Melbury Marly Chalk / basal Zig Zag Chalk.

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(46) Brash in scree at base of northern face of old chalk pit (east end of pit), 1.96 km WNW of St Martha's Hill Church, 1.22 km NE of Shalford Church.
1:10 000 TQ04NW NGR: TQ 0086 4858
Specimen nos: ARF 2791

The specimen is an inoceramid bivalve, possibly *Inoceramus atlanticus*.

Conclusion: Grey Chalk Subgroup, ?Zig Zag Chalk Formation.

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(47) Brash on southern scarp of Pewley Down by footpath, 2.13 km WNW of St Martha's Hill Church, 1.36 km NE of Shalford Church.
1:10 000 TQ04NW NGR: TQ 0074 4888
Specimen nos: ARF 2792

The specimen comprises an oyster and the crinoid *Bourgueticrinus*.

Conclusion: White Chalk Subgroup, Seaford Chalk or younger.

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(48) Brash in base of old pit, Pewley Down, Guildford, by path, 2.22 km WNW of St Martha's Hill Church, 1.33 km NE of Shalford Church.
1:10 000 TQ04NW NGR: TQ 0067 4890
Specimen nos: ARF 2793 – 2795

The specimens include:
Bryozoa: bryozoan
Bivalvia: oysters
Echinoidea: *Micraster coranguinum*

Interpretation: The fauna suggests Seaford Chalk Formation or younger. However, this locality was recently visited by MAW (December 2014; results yet to be reported), and good nodular chalk (cf. Lewes Nodular Chalk), with sponge remains and a terebratulid brachiopod was found at the western margin of this pit. This contrasts with the firm, smooth-textured, blocky chalk found in the central part of the pit, and suggests the presence of a fault.

Conclusion: White Chalk Subgroup, Seaford Chalk Formation or younger.

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(49) Brash on footpath, 80 SW of Chantry View Rd, 2.22 km WNW of St Martha's Hill Church, 970 m SSE of Guildford Castle.
1:10 000 TQ04NW NGR: TQ 0024 4847
Specimen nos: ARF 2796 – 2797

The specimens include the bivalve *Mytiloides?*, in hard chalk with shell fragments.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(50) Pit on north side of minor road, 425 m NW of Seale Church, 1.44 km SE of A331/A31 roundabout.

1:10 000 SU84NE NGR: SU 8931 4810
Specimen nos: ARF 2811 – 2817

The fauna, in hard chalk, includes the brachiopod *Orbirhynchia* and the inoceramid bivalve *Mytiloides*. This is close to (**9**) and (**10**) above.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Turonian, *Mytiloides* spp. Zone.

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(51) Pit at base of slope, 600 m NW of Puttenham Church, by old limekiln.
1:10 000 SU94NE NGR: SU 9274 4806
Specimen nos: ARF 2818 – 2820

The specimens include the brachiopod *Orbirhynchia mantelliana*, an oyster, and the ammonite *Acanthoceras?* or possibly *Calycoceras* (*Newboldiceras*) sp.

Interpretation: The *O. mantelliana* probably correlates with the Upper Orbirhynchia mantelliana Band (e.g. Mortimore et al, 2001, fig. 3.119)

Conclusion: Grey Chalk Subgroup, lower Zig Zag Chalk Formation; Middle Cenomanian, *A. rhotomagense* Zone.

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(52) SIGMA Field Obs Point (FOP) RKW_7: Exposure at top (north) end of Chalk pit, 380m ENE of Conduit Farm.
1:10 000 SU94NE NGR: SU 97586 48360
Specimen nos: RKW 242 – 243

The material comprises the bivalve *Mytiloides* spp., including good three-dimensional specimens, in dense, hard, nodular chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk; Turonian, *Mytiloides* spp. Zone.

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(53) SIGMA FOP RKW_8A: temporary exposure in garden excavation, north side of road, 230m NE of Guildford cemetery chapel.
1:10 000 SU94NE NGR: SU 99202 49222
Specimen nos: RKW 244 – 246

The material includes the echinoid *Micraster* (*Isomicraster*) *gibbus?*, an inoceramid shell fragment and an oyster, in soft chalk.

Conclusion: White Chalk Subgroup, ? mid Seaford Chalk Formation; Coniacian or Santonian, *M. coranguinum* Zone.

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(54) SIGMA FOP RKW_9A: small exposure in road cutting, S side of road, 195m NE of Guildford cemetery chapel.
1:10 000 SU94NE NGR: SU 99188 49181
Specimen nos: RKW 247

The specimen is the echinoid *Echinocorys?* (test fragment).

Conclusion: None possible.

(55) SIGMA FOP RKW_9B: scrappy exposure in cutting behind portakabins, NW side of Guildford Station.
1:10 000 SU94NE NGR: SU 99060 49650
Specimen nos: RKW 248

The specimen is an inoceramid shell fragment. The close growth lines are somewhat similar to *Cordiceramus*.

Conclusion: White Chalk Subgroup, (?upper) Seaford Chalk Formation.

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(56) SIGMA FOP RKW_11: spoil from recent drainage excavations, end of track, 168m SW of Guildford cemetery chapel.
1:10 000 SU94NE NGR: SU 98966 48899
Specimen nos: RKW 249

The specimen is the brachiopod *Terebratulina striatula*.

Conclusion: None possible.

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(57) SIGMA FOP RKW_12: brash at N end of ploughed out pit, 275m NNW of Piccards Farm yard (counterpart to RKW_250).
1:10 000 SU94NE NGR: SU 98149 48509
Specimen nos: RKW 250 – 251

The specimens comprise the inoceramid bivalve *Mytiloides?* and a terebratulid? brachiopod, in moderately hard chalk.

Interpretation: Probably *Mytiloides* spp. Zone and Holywell Nodular Chalk, but morphology of *Mytiloides* is unusual. The possibility of a late Turonian age (suggesting Lewes Nodular Chalk) cannot be excluded. Field relations appear to favour Holywell Nodular Chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk; Turonian, ?*Mytiloides* spp. Zone.

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(58) SIGMA FOP RKW_13: tree root exposure, south side of track, 130m E of end of track at Sunnydown.
1:10 000 SU94NE NGR: SU 96850 48611
Specimen nos: RKW 252 – 253

The specimen includes inoceramid shell fragments, including *?Platyceramus*.

Conclusion: White Chalk Subgroup, ?Seaford Chalk Formation.

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(59) SIGMA FOP RKW_14: field brash 255m WSW of radio masts/reservoir nr Onslow.
1:10 000 SU94NE NGR: SU 97187 48515
Specimen nos: RKW 254

The specimen includes a ?terebratulid brachiopod and an inoceramid bivalve, possibly a Late Turonian form of *Mytiloides* or *Inoceramus* sp. The material occurs in moderately hard, grainy-textured chalk.

Conclusion: White Chalk Subgroup, ? Lower – Middle Lewes Nodular Chalk Formation.

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(60) SIGMA FOP RKW_16: brash in small road cutting N side of road, 60m W of Sunndown driveway entrance.
1:10 000 SU94NE NGR: SU 96621 48592
Specimen nos: RKW 255 – 260

The material comprises inoceramid shell fragments, including *Platyceramus* and *?Volviceramus involutus* (LV frag).

Conclusion: White Chalk Subgroup, ?lower Seaford Chalk Formation.

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(61) SIGMA FOP RKW_18: brash at top of old pit, 390m SW of Sunndown driveway entrance.
1:10 000 SU94NE NGR: SU 96428 48316
Specimen nos: RKW 261 – 263

The specimens comprise Early Turonian forms of the inoceramid bivalve *Mytiloides*, including good three-dimensional forms in hard, dense chalk.

Conclusion: White Chalk Subgroup, Holywell Nodular Chalk Formation; Early Turonian, *Mytiloides* spp. Zone.

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(62) SIGMA FOP RKW_23: exposure in old Chalk pit, 260m NNW of Conduit Farm.
1:10 000 SU94NE NGR: SU 97107 48359
Specimen nos: RKW 264 – 265

The specimens include the bivalve *?Inoceramus pictus*, in very smooth, creamy-coloured chalk.

Conclusion: Grey Chalk Subgroup, ?upper Zig Zag Chalk Formation.

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(63) SIGMA FOP RKW_31A: brash in old pit, E end of Chalkpit Wood.
1:10 000 SU94NE NGR: SU 95620 48936
Specimen nos: RKW 266 – 267

The specimens include the brachiopod *Kingena?*, in very soft, low density chalk.

Interpretation: *Kingena* is a common element of the fauna at (**3**) above, where the associated fauna (in similar chalk lithology) suggested possible assignment to the lower Newhaven Chalk.

Conclusion: None possible, but compatible with lower Newhaven Chalk Formation.

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(64) SIGMA FOP RKW_33: Exposure on west side of old Chalk pit, 370m ESE of Wanborough Manor house.
1:10 000 SU94NW NGR: SU 93846 48840
Specimen nos: RKW 268 – 277

The fauna is as follows:

Porifera:	sponge?
Bivalvia:	inoceramid shell fragments
	oysters, including *?Pseudoperna boucheroni*
	Platyceramus?
Crinoidea:	*Bourgueticrinus* sp.
	Marsupites testudinarius (small, moderately ornamented)
Echinoidea:	test fragments

Conclusion: White Chalk Subgroup, lower Newhaven Chalk Formation; Santonian, *M. testdinarius* Zone.

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(65) SIGMA FOP RKW_34: loose material in base of old Chalk pit, 830m W of Wanborough Manor house.
1:10 000 SU94NW NGR: SU 92650 48864
Specimen nos: RKW 278 – 287

This locality is very close to (**35**) above.

The fauna is as follows:

Porifera:	*Porosphaera* sp.
Bivalvia:	oysters
	Acutostrea incurva
	inoceramid shell (very thick fragments)
	Pseudoperna boucheroni
	?P. boucheroni
Echinoidea:	test fragments

Interpretation: The oyster fauna, especially *P. boucheroni*, suggests assignment to the lower Newhaven Chalk Formation, which was also suggested by the fauna at (**35**) above.

Conclusion: White Chalk Subgroup, ?lower Newhaven Chalk Formation.

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(66) SIGMA FOP RKW_39: fallen blocks at base of 25m exposure in old Chalk pit, 560m ENE Greyfriars Farm.
1:10 000 SU94NE NGR: SU 95071 48335
Specimen nos: RKW 288 – 293

The fauna is as follows:

Brachiopoda:	*Cretirhynchia* sp.
	Kingena?
	Gibbithyris ellipsoidalis?
	terebratulid?
Crinoidea:	*Bourgueticrinus* (columnal)
Echinoidea:	*Echinocorys* sp. (incomplete)

Interpretation: Several aspects of the fauna suggest Seaford Chalk, but the field context, along strike from undoubted Lewes Nodular Chalk at (**2**) above, make this

doubtful. This section should be visited by MAW for examination of the in situ succession.

Conclusion: Uncertain

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(67) SIGMA FOP RKW_41: brash from recently dug drains, track entrance, 170m SW of Guildford Cemetery chapel.
1:10 000 SU94NE NGR: SU 98948 48909
Specimen nos: RKW 294 – 298

The fauna is as follows:

Bivalvia:	*?Cladoceramus undulatoplicatus*
	Platyceramus?
	oyster
Echinoidea:	*Micraster* sp. (mammillated periplastron)

Conclusion: White Chalk Subgroup, ?middle Seaford Chalk Formation.

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(68) SIGMA FOP RKW_43: loose material at NE corner of hospital construction site, 230m WSW of Guildford Station.
1:10 000 SU94NE NGR: SU 98945 49499
Specimen nos: RKW 299

The specimen is an asteroid skeletal plate.

Conclusion: None possible.

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(69) SIGMA FOP RKW_33: Exposure on west side of old Chalk pit, 370m ESE of Wanborough Manor house (note follows from sample RKW_277).
1:10 000 SU94NE NGR: SU 93846 48840
Specimen nos: RKW 300

The specimen is the crinoid *Marsupites testudinarius* (small, smooth morphotype).

Conclusion: White Chalk Subgroup, lower Newhaven Chalk Formation; Santonian, *M. testudinarius* Zone.

Appendix 1 – Author citations for fossil species

Acanthoceras rhotomagense (Brongniart, 1822)

Acutostea incurva (Nilsson, 1827)

Cladoceramus undulatoplicatus (Röemer, 1855)

Cremnoceramus crassus (Petrascheck, 1903)

Cremnoceramus deformis deformis (Meek, 1872)

Entolium orbiculare (J Sowerby, 1817)

Gibbithyris ellipsoidalis Sahni, 1929

Hyotissa semiplana (J de C Sowerby, 1825)

Inoceramus atlanticus (Heinz, 1936)

Inoceramus cuvieri J Sowerby, 1814

Inoceramus lusatiae Andert, 1911

Inoceramus pictus J de C Sowerby, 1829

Inoceramus virgatus Schlüter, 1877

Isocrania paucicostata (Bosquet, 1859)

Kingena lima (Defrance 1828)

Marsupites testudinarius (Schlotheim, 1820)

Merklinia variabilis (Hagenow, 1842)

Micraster (*Isomicraster*) *gibbus* (Lamarck, 1816)

Micraster coranguinum (Leske, 1778)

Micraster cortestudinarium (Goldfuss, 1826)

Micraster normanniae Bucaille, 1883

Mimachlamys cretosa (Defrance *in* Brongniart 1822)

Mytiloides incertus (Jimbo, 1894)

Mytiloides mytiloides (Mantell, 1822)

Neithea sexcostata (Woodward, 1833)

Orbirhynchia mantelliana (J de C Sowerby, 1826)

Plagiostoma globosum J de C Sowerby, 1836

Plesiocorys (*Sternotaxis*) *plana* (Mantell, 1822)

Pseudoperna boucheroni (Woods *non* Coquand, 1859)

Pycnodonte vesiculare (Lamarck, 1806)

Terebratulina lata Etheridge, 1881

Terebratulina striatula (Mantell, 1822)

Turrilites costatus Lamarck, 1801

Volviceramus involutus (J de C Sowerby, 1828)

References

MORTIMORE, R N, WOOD, C J, GALLOIS, R W. 2001. British Upper Cretaceous Stratigraphy. Geological Conservation Review Series, No. 23. (Peterborough: Joint Nature Conservation Committee.)

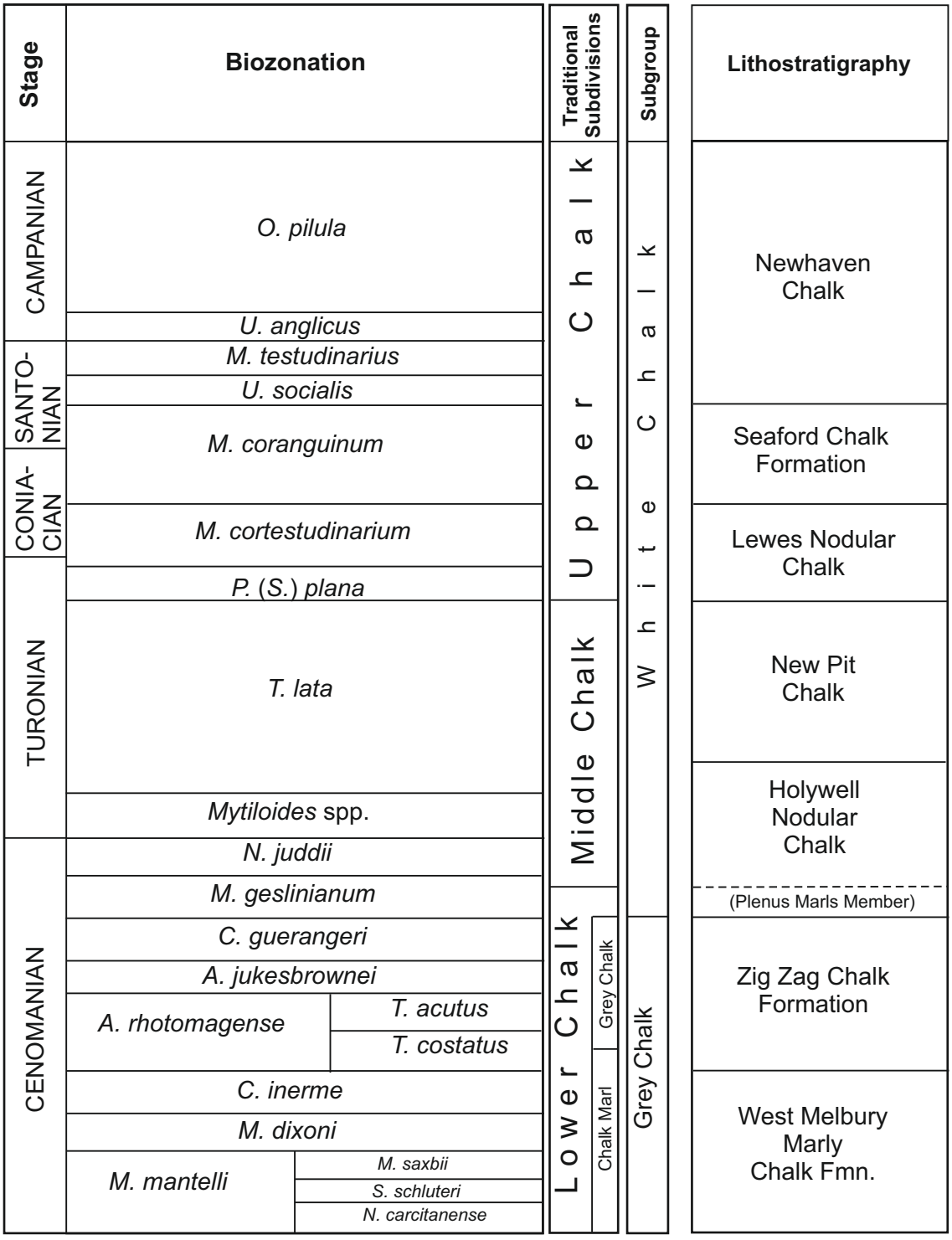

Table 1. The stratigraphy of the Chalk Group referred to in this report. (not to scale)